WASHINGTON
SCIENCE TRENDS

HIGHLIGHTS

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* NEW TRANSMISSION DEVICE

A new transmission device, said to have "remarkably wide" application possibilities, has been developed at Government laboratories at Huntsville, Ala.

"The device can be built as a component of remarkable compactness which offers maximum flexibility of component arrangement," according to its inventors. "The simple composition permits easy commanding and adjustment, low-cost manufacturing and long-time storage ability."

A new report published by the National Aeronautics and Space Administration, indicates:

Requirement: "In many technical applications, motion or power drives require reversibility of motion direction of the driven member at a rather high rate. For an optimum design, it appears desirable to insert the direction reverser next to the high-speed level of the driving power source (electro-motor). This way, the transmitted torques are comparatively small and the elements accomplishing the reversal of motion can be extremely light weight -- which in turn makes possible a rapid response due to the low inertia."

Mechanism: The device is specifically designed for transmission of motion or power between a driving shaft and a coplanar or straight line driven shaft. By means of this mechanism, the driven shaft can be successively rotated clockwise and counterclockwise by a driving shaft rotating continuously in one direction. Reversibility of rotation of the driven shaft can be achieved at extremely high rates because of the very small displacement and low inertia."

Applications: The inventors point out that extremely fast reversibility of motion direction is required for servo-control systems in which the proper velocity and displacement of the controlled member is obtained by:

- ✓ Pulsing on-off operation of the transmission device, as frequently applied for vane control of guided missiles, space vehicles, etc.
- ✓ Varying the speed of the drive motor, as employed in controlled drive of tool supports, rudders of boats, etc.

(Report Available. Single Copies Free. Write National Aeronautics and Space Administration, 1520 H Street, N. W., Washington 25, D. C. for NASA Technical Note D-603 by J. Boehm, A. L. Herrmann and J. F. Blanche. Also see U. S. Patents No. 2,950,624 and 2,941,408)

* SOLID PROPELLANT BOOSTERS: Air Force officials now estimate that their new research and development program for solid propellant space boosters will eventually cost close to $2 billion, exclusive of production orders. Thrust levels of two to three million pounds are envisioned.

* MAGNETOPLASMADYNAMICS RESEARCH

National Aeronautics and Space Administration expects to spend $3.98 million in the coming Fiscal Year for equipment in the field of magnetoplasmadynamics research at its Langley (Va.) Research Center.

Implications: NASA has advised Congress that the results of research on the motion of an electrically conducting gas (or plasma) in the presence of magnetic or electric fields can have potentially important applications on long-distance space communications, ultra-high velocity wind tunnels for re-entry research, and propulsion and power generation.

Officials caution however that "The science is still in its infancy and it is clear that a great deal of fundamental research, particularly experimental research, needs to be accomplished."

Some specific examples outlined by NASA of ideas which may lead to future applications:

✓ New ideas for the confinement and manipulation of plasmas.

✓ New concept for the acceleration of plasmas by the use of radiation pressure from microwaves. Plasma velocities of the order of millions of miles per hour appear possible from analysis and small-scale experiments, but very high-power microwave sources are needed. Results could have application to all devices using high velocity plasmas, such as the colliding plasma transmitter.

✓ New concepts and methods for the conversion of electrical energy to plasma motion and, conversely, the conversion of plasma motion to electricity.

✓ Acceleration of relatively dense plasmas to very high speeds, for possible application in the problems of hypervelocity flight research.

✓ Production of very intense electromagnetic radiation in the microwave spectrum by collision of high-speed plasmas. The results may have application in an extremely high-power transmitter for communication over great distances in space.

Procurement plans for this facility include:

✓ Electric energy storage bank (capacitors) for creation and acceleration of plasmas.

✓ Six-phase a-c silicon rectified to d-c power source for steady flow d-c plasma accelerator and for small arc jets (plasma sources) used in basic studies.

✓ Laboratory-scale microwave equipment for plasma velocity measurements, determination of plasma characteristics and studies of radio transmission through ionized layers.

✓ High-power microwave equipment for generating and guiding microwaves for use in acceleration of plasmas by means of radiation pressure.

✓ Fractional microsecond Kerr cell and framing camera for observing plasma motions and interactions with magnetic fields.

✓ Vacuum pumps, piping and filters to remove alkali metal seeding elements from plasma flows dumping into vacuum tank.

✓ Special instrumentation including ion and electron accelerators, mass spectograph and high-field-strength electromagnets and general laboratory instrumentation such as vacuum gages, oscilliscopes, electrical instruments, etc.

✓ Specially constructed channel for steady flow-d-c plasma accelerator.

✓ Specially fabricated cyanogen burner as a plasma source.

✓ Special stainless-steel vacuum cylinder for plasma-dynamics studies.

✓ Special 60-foot spherical vacuum reservoir to be used as a receiver for most of the flowing-plasma studies.

TECHNICAL TRENDS

□ Civil Defense Officials have appointed a special task force to speed development of a National Emergency Alarm Repeater (NEAR) system, which features an alert receiver to be plugged into home electric wall sockets. √√√ The use of bacteria to alter minerals is described in Information Circular 8003 now available from the Publication-Distribution Office, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. No charge for single copies. √√√ The Northrop Corp., Hawthorne, Calif. and Space Technology Laboratories, Inc. are preparing flight performance manuals which will detail the techniques and principles involved in launching earth satellites and conducting earth-orbital operations. The manuals are to be completed by September, 1961 for the Marshall Space Flight Center, Huntsville, Ala. √√√ A new statistical picture of the copper industry is available at 15 cents from the Publications Office, U. S. Department of Commerce, Washington 25, D. C. Ask for Copper Industry Report, Annual Supplement No. 5. √√√ The increased dollar volume of U. S. photographic product imports is outlined in Announcement BD-61-104 available from Photographic Products Division, BDSA, U. S. Department of Commerce, Washington 25, D. C.

□ The Safety and Fire Protection Branch, U. S. Atomic Energy Commission, Washington 25, D. C. has available a warning of the pyrographic hazard of powder metallurgy specimens. Ask for Announcement No. 124. √√√ The new Office of Coal Research, U. S. Department of Interior, Washington 25, D. C. has already received proposals for some 60 sponsored research projects, and is looking for more. √√√ The U. S. Bureau of Mines plans to install a large gamma irradiation facility at its Albany, Ore. Metallurgy Research Center. √√√ Dr. Gerald Johnson, University of California physicist will be the new chairman of the Military Liaison Committee to the Atomic Energy Commission, where a dispute on the atomic weapon output rate is reported underway. √√√ An Automatic Data Processing Information Exchange has been established by the U. S. Civil Service Commission at Room 301, Main Civil Service Building, 8th and F Streets, N. W., Washington 25, D. C. for Government personnel interested in applying ADP techniques to personnel programs.

□ The Army has cutback by $8.1 million its procurement plans for the AN/APN-118 airborne integrated navigator radar set to allow additional time for evaluation and testing. The money will go to the light observation helicopter program instead. √√√ U. S. intelligence agencies report a growing volume of "popular" articles in the Soviet press on the possibility of past or present human life on Mars. √√√ The Navy has quietly awarded a study contract to Chrysler Missile Division, Detroit, Mich., on the feasibility of converting an existing Navy ship into a satellite and space probe launching unit. √√√ The U. S. Bureau of the Census, Washington 25, D. C. in Publication BDSAF-363A(60-1) has available for 10 cents statistics on the U. S. Communication Equipment Industry for 1960. √√√ A similar report on Office, Computing and Accounting Machines is also available at 10 cents as Series M35R(60)-1. √√√ The Director, Projects Administration Division, GSA Defense Materials Service, Washington 25, D. C. has asked for bids on surplus ground steatite talc useful for dies in the production of electron tube insulators.

□ The U. S. Venus probe will hopefully be launched August 23 or September 19, 1962. √√√ Army officials are anxious to develop new camouflage techniques for their helicopters, both in flight and on the ground. Reflections from plexiglass is a particularly troublesome problem. √√√ Copies of COBOL-61 are expected to be available next month from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. This is the revised version of the report on a Common Business Oriented Language for programming digital computers. √√√ The Army says it is now sold on the need for a "flying crane" and initial plans call for a machine capable of lifting an 8 to 12 ton load and carrying it about 25 miles. √√√ The problems of encouraging Government scientific advisors not to destroy the nation's technical opportunities through an overabundance of caution are discussed in "Atomic Science and Government," a thought-provoking address available from the Office of Rep. Melvin Price, U. S. House of Representatives, Washington 25, D. C.

RESEARCH CHECKLIST

□ PHOTOTRANSISTOR TACHOMETER: The Navy has developed a new device which is said to provide a superior means of measuring the spin rate of models being tested in wind tunnels. The so-called phototransistor tachometer is said to measure a greater range of frequencies while presenting a stronger signal, with a better signal-to-noise ratio, than that obtained by methods used previously. In operation, a perforated wheel rotates with the model and interrupts a light beam from the lamp to the phototransistor. Since a phototransistor changes its resistance when exposed to a pulse of light, by varying the exposure an electrical signal may be obtained for each change of light intensity.

(Phototransistor tachometer developed by C. F. Miller, Applied Aerodynamics Department, U. S. Naval Ordnance Laboratory, White Oak, Silver Spring, Md.)

□ FIRE CONTROL RESEARCH: Studies by the National Bureau of Standards indicate that certain chemical fire inhibitors are "significantly more effective" when applied to the air around the flame, rather than to the burning fuel or to the center of the flame. The laboratory-scale experiments used the inhibitors trifluoromethyl bromide and methyl bromide in connection with flames of hydrogen, methane, ethane, propane, butane and carbon monoxide. Investigators are still attempting to find the reason for the observed results. They believe that perhaps the mechanism of inhibition depends upon properties of the intact inhibitor molecule, rather than on its decomposition products.

(Write National Bureau of Standards, Office of Technical Information, Washington 25, D. C. for further information on "Inhibition of Combuston Reactions")

□ UNBALANCED LINE DIRECTIONAL COUPLER: Studies by the Sandia Corp. for the Atomic Energy Commission have led to basic information for design of an unbalanced transmission line directional coupler. Such couplers have been used as power sampling devices, taking advantage of the close proximity of two or more transmission line systems for couple electromagnetic energy from one transmission line to other transmission lines. Coupling was first noted as an objectionable characteristic in telephone lines. However, through the directional coupler this can be used to sample RF energy in a circuit without appreciably affecting the operational characteristics of the original circuit.

(Analysis and equations specifying characteristics now available as Publication SCTM 428-60 (14) through AEC channels or at 50 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)

□ SULFUR DIOXIDE STUDIES: The U. S. Bureau of Mines is developing processes for the removal of low concentrations of toxic sulfur dioxide from large volumes of combustion gases. The Bureau notes that although capital outlay and operating costs for a purification process will be high, public pressure for cleaner air may enforce enactment of legislation compelling the use of flue gas scrubbing. Bench-scale tests have been encouraging but further studies will be undertaken to determine if removal by hot solids can be feasible on an industrial scale.

(Report on bench-scale experiments and plan for further investigations now available. Single Copies Free. Write Publication-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigations No. 5735)

□ INITIAL PEAK SURGE CURRENT DETECTION: The Sandia Corp., under contract to the Atomic Energy Commission, has designed special circuits which indicate when initial peak surge current exceeds a certain set value. However, peak current surges other than the initial surge cannot be accurately determined. Details of the circuits are now available, but no mention is made of the application.

(Report SCTM-431-60(24) available through AEC channels or at 50 cents from OTS, U. S. Department of Commerce, Washington 25, D. C.)

□ ULTRASONIC INSPECTION OF SOLID FUEL ROCKET MOTORS: Studies for the U. S. Air Force, now available, indicate a number of problems in the application of ultrasonic inspection techniques to solid fuel rocket motors. Both single and two-transducer techniques were investigated to determine the feasibility of detecting unbonded areas at the case-liner and liner-propellant interfaces. Various multiple case reflections caused difficulties when the single transducer was used, while the two transducer technique introduced a number of other complexities.

(Studies by Ultrasonic Division, Automation Industries Inc. now available as WADD Technical Report 60-553 ((PB 171 499)) available through military channels or at $2.50 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

□ SPACE LUBRICATION RESEARCH: Gold and other precious metals are being studied for use in journal bearing operation at temperatures ranging from -90° to 2000°F and through a wide range of atmospheric pressures for space applications. Lubrication techniques being investigated under Air Force contract include lubrication by precious metal films, by gas-formed surface compounds, by glasses and by dry powdered lubricants. Precious metal film lubrication of cermets has been particularly promising. It was also found that a columbium-based alloy possesses good high-temperature strength and much better impact resistance than cermets tested -- making it attractive for journals running, perhaps, in cermet bearings.

(Studies by Department of Aerospace Propulsion Research, Southwest Research Institute, San Antonio, Texas)

□ CONVECTIVE CURRENTS IN WATER: Some of the convection phenomena observed in fields such as oceanography, meteorology, astrophysics and hydraulic engineering may be better understood as a result of recent studies by the National Bureau of Standards. Experimental results with a schlieren optical system demonstrated vigorous and persistent mixing motions in apparently still water. The motions are explained as convective currents induced by the normal, evaporative cooling of the surface layer which occurs in any lake, pond or body of water exposed to still air. The motions, which took the form of plunging vertical sheets, become increasingly vigorous when the air circulates freely over the surface.

(For details of "A Study of Convective Currents in Water" write National Bureau of Standards, Office of Technical Information, Washington 25, D. C.)

□ PREPARING DUCTILE VANADIUM: Bureau of Mines studies indicate that a process based on the metallic reduction of vanadium trichloride appears to offer the greatest possibility for the production of low-cost vanadium metal of uniformly high purity. Before vanadium is made available in tonnage quantities for use as a material of construction, the Bureau points out, it must be prepared by a procedure that is adaptable to large-scale operation. Investigators believe that metallothermic reduction should be adaptable to processing in large retort batches of several hundreds of pounds as is presently done in the Kroll process for making zirconium and titanium.

□ NEW SPECTROCHEMICAL STANDARDS: The National Bureau of Standards has two new types of spectrochemical standards available for purchase for use in both optical emission and X-ray analysis studies. The new samples include a set of eight white cast-irons, and a set of three naval brasses, prepared by a special casting technique.

(For further information write Standard Samples Clerk, National Bureau of Standards, Washington 25, D. C.)

PUBLICATION CHECKLIST

- ☐ MARINE SCIENCES, testimony, statements and exhibits presented to Congress on proposals for a large-scale expansion of the national oceanographic program. 204 Pages. Single Copies Free. (Write Sen. Warren G. Magnuson, Chairman, Committee on Interstate and Foreign Commerce, Washington 25, D. C. for Hearings-Marine Science, S-901 and S-1189)

- ☐ SATELLITE COMMUNICATIONS, a technical study suggesting limitations for use in the allocation of satellite to ground communication systems on shared channels. Single Copies Free. (Write FCC Technical Research Division, Room 2216, New Post Office Building, Washington 25, D. C. for T.R.R. 5.2.1, "Suggested Criteria for Limiting Satellite Power")

- ☐ HEALTH HAZARDS IN URANIUM MINES, a publication charging that serious health hazards exist in the uranium mining industry. Single Copies Free. (Write Publications Inquiry Unit, U. S. Public Health Service, Department of HEW, Washington 25, D. C. for PHS Publication No. 843)

- ☐ SINTERED COPPER POWDER, a U. S. Government translation of a Soviet paper on development of sintered copper powder said to be particularly interesting in terms of structure, electrical resistance and mechanical properties. 8 Pages. Single Copies Free. (Write National Aeronautics and Space Administration, 1520 H Street, N. W., Washington 25, D. C., ATTN: CODE BID for NASA Technical Translation F-64)

- ☐ HYDROFOILS, an annotated bibliography prepared by the Lockheed Corp. as the result of a brief investigation of recent developments in hydrofoil design and testing. Includes information on some 85 studies as of 1960. (Lockheed Special Bibliography 60-36 ((PB 171 502)) available through military channels or at $1 from OTS, U. S. Department of Commerce, Washington 25, D.C.)

- ☐ HANDLING AND STORAGE OF LIQUID PROPELLANTS, a Defense Department publication containing information on the general properties, hazards, safety measures, transfer and storage and shipping of various types of liquid propellants. 248 Pages. $1.25. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Publication D 4.10:P 94)

- ☐ CORRECTED OPTICAL PYROMETER READINGS, a table designed to enable optical pyrometer users to convert immediately observed temperatures to true temperatures or to determine effective emissivity if true temperature is known. 74 Pages. 55 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for National Bureau of Standards Monograph No. 30)

- ☐ URANIUM CARBIDE, the proceedings of a conference held at Oak Ridge National Laboratory December 1-2, 1960 to report on the state of the art in uranium carbide for application as a superior nuclear fuel material. 162 Pages. (Report TID 7603 available through AEC channels or at $1.75 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- ☐ ENGINEERING DESIGN SERVOMECHANISM GUIDE, a four-volume series prepared at Duke University for Army Ordnance. (Details on price and ordering information available in Announcement 61-414, free from Public Information Division, OTS, U. S. Department of Commerce, Washington 25, D. C.)